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On Broadband
Wireless Internet Access

Independent, original, in-depth coverage of the trends and technologies shaping the Broadband Wireless Internet Access / WiMAX industry

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Steve Stroh, Editor

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We're In The Midst Of A *Quiet* Connectivity Revolution

It's unlikely to have escaped your attention that there's a connectivity revolution going on right now. It's tough *not* have heard about WiMAX by now. One example is a stunt by a Seattle-based ISP called Speakeasy that worked out a deal to place a "pre-WiMAX" Broadband Wireless Internet Access base station on the Seattle Space Needle. The general public might not remember the term WiMAX a day later… but Speakeasy's clever PR made sure that nearly every Seattle resident had *heard* the term WiMAX. Intel's willingness to invest $Billions over a long term has resulted in partnerships with a number of major service providers that have agreed to "trial" WiMAX systems. In fact, the current very high profile of WiMAX technology can be traced almost entirely to Intel's investments in other companies, marketing, and creating Intel WiMAX chipsets.

Another connectivity "revolution" (a decade or so in the making) is the "3G" technologies of 1xRTT and its evolution to 1xEV-DO, the latest flavor of Broadband Wireless Internet Access based on CDMA wireless telephony. Verizon Wireless is trumpeting its 1xEV-DO-based BroadbandAccess network and is spending $Billions to deploy it. Cingular will follow with equivalent technology for its GSM-based network, and Sprint/Nextel and T-Mobile are making noises that they too will spend $Billions and deploy Broadband on their wireless telephony networks.

Still another connectivity revolution is the prevailing view that the wireless telephones will evolve to become the dominant personal communications and computing device that most people use. In this worldview, wireless telephones will subsume the roles of audio and video entertainment receivers, cameras, recorded audio players, address book, calendar, gaming terminal, biorhythm tracker, female fertility predictor… ad nauseum.

There is much chest thumping and prognosticating about the benefits of the conversion of spectrum formerly used for television broadcasting to communications use. Some has already happened, such as the 700 MHz band. There is much posturing by the television broadcasters about how best to "protect" the remaining sliver of over-the-air viewers once a complete conversion to digital broadcasting has been finally implemented. The congress is eager to auction additional television spectrum so that $Billions can be extracted from eager bidders.

The above are all examples of what I'm calling the "Noisy" Connectivity Revolution. Here are some others:
- Comcast is upgrading their standard offering to 6 Mbps downstream to users, with a teaser price of $19.95/month for six months;
- Wireline telephony companies are offering similar deals for DSL, desperately trying to stave off the inevitable "bits per buck" comparisons that consumers have a nasty habit of doing until they can either offer fiber or a more advanced variant of DSL, or a combination of the two;
- Verizon is finally deploying fiber-to-the-home that seems to be the real thing, not merely yet-another-market/technical-trial (albeit in very limited, affluent markets;
- Satellite Broadband Internet Access for consumers is back again, this time via WildBlue's more advanced satellite, intimate knowledge of what not to do from their nearly-escaped-corporate-death predecessors, and five years of better and cheaper technology for the consumer "earth stations".

But the "Noisy" Connectivity Revolution isn't what I will be writing about. What follows is a *highly contrarian* view, that the "Noisy" connectivity revolution may well be usurped by the "Quiet" connectivity revolution that most people aren't really aware of… or at least, they're not aware of just how big and how pervasive the Quiet Connectivity Revolution has become. The outlines of it are so subtle as to be barely visible. I'm going to try to give you a guide so you can see it yourself.

Permit me a bit of scenario-setting.

I think that one of the most revolutionary pieces of technology of recent times is the Apple iPod. I don't like it for the usual reasons cited – its excellent design, the fact of the lately-developing "if-it's-from-Apple-it-*must*-be-cool" halo effect. No, what I admire is that Apple was able to position itself incredibly well as an entire ecosystem of consumer audio – not just the player; lots of vendors make players. Not just the software on the PC – iTunes was predated by a number of such software, especially on the PC. Not just iTunes Music Store– Microsoft has an audio store, as do others that want to plug into the Microsoft-technology portable music players (you don't hear about them much any more

compared to iTunes.) But Apple was first to get it right, and get it *best* with iTunes Music Store that you can get to from a web browser, or as part of iTunes on any Internet-connected PC or Macintosh. The iPod, the iTunes software, and the iTunes Music Store form an ecosystem that can, and will have a number of second, third, fourth-order effects that are not yet visible (some of these aren't visible even to Apple – they don't quite know what they really have. But they're learning quickly.)

Another revolution underway is podcasting, and the iPod ecosystem is perfectly positioned to exploit it and dominate it. Podcasting, if you weren't aware, is a capability to automatically download audio content as it's made available to your portable audio device. While podcasting was named for the iPod, the technology is hardly limited to iPods (though it works very, very well with iPods.) Because podcasting piggybacks on RSS (sorry, but if I try to do even an abbreviated explanation, this piece will get *very* long) and RSS is an open-source technology, very much is being made of the fact that even amateurs can start providing podcasts in much the way that free host-based Weblog software has given a web presence to even the most disadvantaged of persons. What I think is that podcasting is an entirely new medium for content distribution of all kinds... including 90% of what is now broadcast on commercial radio stations and soon enough, video. Think TiVo for radio (and television)... that you can carry with you. But as interesting as that potential is... it gets better... much better.

The most hyped device in the iPod family is a collaboration between Apple and Motorola for a Motorola wireless phone with an iPod grafted in. The worst technical issue was probably how to manage battery life between powering a hard disk (if it even has one – it might use flash memory, now up to 4 GB) and powering the transmitter in the phone. The much thornier issue was the potential that the iPod phone would have wireless telephony customer putting content onto a phone device that didn't come through the wireless telephony carrier's "toll road" delivery system and thus drive significant revenue to the carrier. From press reports, the carriers wouldn't budge that content delivered to a wireless telephony phone *had* to come through the carrier's network and thus generate carrier revenue. Again, from reports, Apple didn't budge that iPod customers, current and potential, expected at least the same experience as "standalone" iPod customers have now – individual songs costing $0.99 each and all manner of content, including your current Compact Discs, playable on the iPod for no additional fee. Reportedly this phone will soon debut on Sprint or T-Mobile, and it would certainly be welcome at any number of the new "Mobile Virtual Network Operators" (MVNO's) such as Virgin Mobile that piggyback on established wireless telephony networks.

With absolutely no information leaked or rumored to me, purely on the strength of trends that I'm observing, I believe that Apple is on the cusp of delivering a new type of iPod that would have Wi-Fi built in to it. Such a device would have *enormous* repercussions. I feel that its emergence is not merely possible, or inevitable... it's imminent. (In fairness, I have read some articles that speculate on the likelihood of the eventual emergence of a wireless iPod... but I'm going to explain to you goes way beyond the mere emergence of such a product.)

On the surface, the "iPod Wi-Fi" will be positioned that "you don't have to hard-dock your iPod to get new content. That's true, but you end up having to dock your iPod as much to recharge the battery as you do to download new content. What an iPod Wi-Fi will do is to liberate you from the requirement that you have to *go to the computer* to recharge your iPod; you can buy a simple and cheap recharger (or more than one); the connectivity will be provided by your household Wi-Fi network.

Things get really interesting with the iPod Wi-Fi when you contemplate taking it outside your home… and the Wi-Fi connection *still* works.

Remember that there's three parts to the iPod ecosystem – the iPod, the iTunes software on the host computer, and the iTunes Music Store.

If you have Wi-Fi connectivity, like at a coffee shop, or your office, or your entire college campus… or your entire *town*… the iPod can still communicate with the iTunes Music Store and your account on it.

Now here's where it gets really, really interesting. iTunes Music Store now has the ability to offer Podcasts. However badly Apple is doing it at the moment (and they are doing it badly at the moment), the ability to subscribe to a podcast through the iTunes Music Store means that the iPod Wi-Fi and the iPod Phone can receive podcasts away and apart from the host computer.

This is an *enormous* change to the dynamic of podcasting. This is, in essence, an entirely new media channel, one that was able to evolve under the RADAR of almost everyone in the (what can only be called at this point "legacy") broadcast industry. It's a media channel that is truly vast… unlimited wouldn't be hyperbole here given that higher-end iPods can contain more audio content than one person can be expected to listen to in a significant portion of their lifetime.

Here's one very small, but significant example that comes immediately to mind. An Indian cab driver can subscribe to a podcast of the Indian equivalent of the two hour National Public Radio (NPR) program "Morning Edition". He can leave the house with his iPod Wi-Fi, and while standing in line waiting to get his morning cup of coffee or tea, his iPod Wi-Fi will automatically (it detected that it had Wi-Fi connectivity) download that podcast via iTunes Music Store. So in his cab for the two hours of the podcast, he can be listening to the latest news from India in his native tongue… with no involvement of a paid wireless connection, especially a wireless telephony connection.

College students, faculty, and staff at Dartmouth College have it even better. Their *entire* campus has *saturation* Wi-Fi coverage. As do some towns, such as Grand Haven, Michigan. If users of the still-hypothetical iPod Wi-Fi set up automatic downloads of podcasts, whenever new content is available, their iPod will quietly "ding" (or not) and then there's one more thing to listen to on the iPod.

It's important to reiterate that podcasts are *not* limited to amateur content that has to be free... Rush Limbaugh, Coast To Coast AM (former Art Bell program), various National Public Radio programs, and a growing number of other professional audio content are now becoming available as podcasts in a mix of for-pay and free. The revolution I'm writing about *here* is the creation of a new distribution medium that happens to be equally accessible to amateurs and individuals.

Take this one step further. There's nothing inherent in the technology of the iPod Wi-Fi that necessarily precludes that the content being received has to be classic podcast... a static file that is downloaded. If you have the connectivity (like at Dartmouth), and what you're subscribed to is content that really benefits from being heard live (such as sports), there's no reason why the iPod Wi-Fi can't also accommodate streaming. There is an MP3 format that is essentially open-source streaming technology, and the iPod handles MP3 files just fine... Before you object and say that I've just described a cheap portable AM radio... understand that with a streaming capability, you can listen to a live sportscast from anywhere on the planet – such as a soccer game overseas.

We've only heard about that last capability in the context of wireless telephony; the wireless telephony carriers want to be the ones to deliver that kind of capability to consumers... for a handsome profit. The problem is that what they want to sell you isn't what you really want to hear... or watch. That's why the video rental stores still exist after more than a decade of hundreds of television channels delivered via cable or satellite (that are already paid for... and yet you're willing to pay additional money to watch *what* you want *when* you want by renting a DVD or tape.)

The iPod Wi-Fi is but one piece of the quiet connectivity revolution.

Some Other Small Pieces Of The Quiet Connectivity Revolution

In many cases, the Quiet Connectivity Revolution is wireless little pieces, loosely joined (apologies to David Weinberger for the adaptation of the title of his excellent book).

Some have described the Sony PlayStation Portable (PSP) as a video iPod that happens to do gaming. But one of the most overlooked features of the PSP is the fact that it has Wi-Fi as a standard feature. That feature hasn't been widely touted or exploited... yet... but the fact that Wi-Fi is shipping as a standard feature of a popular consumer device *will* "pull" support for it. In Japan, networks of Wi-Fi HotSpots are being constructed solely for providing connectivity to handheld gamers. While every PSP user is aware that the PSP can play videos (it ships with a movie already in it; Sony apparently hopes to sell lucrative "walled garden" content" to PSP owners), not many non-gamers understand this. Sony would prefer that the general pubic believe that only sanctioned / processed videos can be played, but that's by far not the case. There is a wealth of software that not only makes it possible to download content from DVDs onto a PSP, but also content obtained as an Internet download. What happens if... *when* the Wi-Fi capabilities of the PSP start to be used to download content similar to the iPod Wi-Fi described earlier?

How much more attractive is the PSP video downloads model for portable video viewing on a train or bus commute, or long road trip with the kids in the back seat, or a plane flight, or… The wireless telephony carriers and Qualcomm would have you believe that you'll get the small screen equivalent of the wealth of cable channels on your phone, live (and are making a multi-$Billion investment in spectrum and infrastructure on the basis of that premise.)

For many, Voice Over Internet Protocol (VOIP) has become an absolutely indispensable part of their Internet usage, especially if one needs to communicate via voice overseas, where telephony rates are still expensive. Skype, Vonage, Instant Message clients like AOL Instant Messenger (AIM) all work well, but require a computer to make use of them. But that conventional wisdom is changing quickly as wireless, networking, TCP/IP, and VOIP are all combined into a handheld unit that looks unassumingly like a cordless phone. In fact, the only significant difference of a VOIP over Wi-Fi phone I had for review and the cordless phone on my desk is that the VOIP/Wi-Fi phone has menu buttons for setting things like static IP address.

Yes, portable telephones based on Wi-Fi, using Voice Over Internet Protocol (VOIP) have existed for several years. But they were expensive and proprietary, used in enterprises with extensive Wi-Fi networks. Wi-Fi / VOIP phones are now becoming widely available (offered as OEM products by Asian manufacturers) and getting rapidly cheaper – as low as $150, with some announcements (but not actual shipments yet) of price points below $50. It's short work to ramp volumes and simplify designs. Imagine what happens when Uniden starts to ship a true Wi-Fi / VOIP phones! (Uniden is shipping products that give you the impression that they're Wi-Fi and VOIP… but that's for the connectivity *past* the phone's base station; Uniden doesn't seem to yet be shipping an actual Wi-Fi / VOIP phone.) Think how disruptive this gets when Wi-Fi / VOIP phones approach the low end price point of Uniden cordless phones… $15.00. (one advantage is that any number of VOIP/Wi-Fi phone will work through a wireless access point and end the insanity of having to use multiple docks / base stations / coverage areas for multiple phones.

Vocera makes an amazing product called the Vocera Communications Badge. It's a little "fob" that you carry around much like an ID badge. It works with any enterprise-grade Wi-Fi network. Using the badge is simple; if you've ever seen a character on Star Trek, The Next Generation tapping the badge worn on their tunics, you understand how to use the Vocera Communications (Comm) Badge. A Vocera server in the enterprise "tracks" where each Comm Badge user is… actually, which Wi-Fi Access Point (AP) the user is closest to. To communicate with another Comm Badge user (or, presumably, to call someone on the phone) a user only needs to speak the name of the person you want to talk with. Or… you can summon "nearest trauma surgeon". If Vocera had implemented this technology on a proprietary wireless system, it would have likely failed. The deployment costs would simply be too steep. Instead, the Vocera system "piggybacks" on an *existing* Wi-Fi network… not limited to hospitals (where it's been most popular) or even "indoors". Wayport is now offering Vocera services on a turnkey basis for hotels and other venues of its for-pay Wi-Fi HotSpot services. Dartmouth College will be

deploying a pilot Vocera system that will work campus-wide. How does such a system impact the popularity of Push-To-Talk wireless telephony / two way radio services like Nextel?

Networks Of The Quiet Connectivity Revolution

Wi-Fi in the home has quietly gone from "fussy" to "works pretty well" with the advent of a mass market implementation of an not-so-new technology – Multiple Input Multiple Output (MIMO). MIMO has the effect of focusing a Wi-Fi base station's energy at the Wi-Fi user that is talking to it at the moment, resulting in more reliable operation of the Wi-Fi network in general because more transmitted power is directed where it's needed, and other sources of 2.4 GHz transmissions (like microwave ovens) can be (directionally) ignored because most of the time there's no Wi-Fi units in the same exact direction as the microwave oven. Another little-noticed factor with Wi-Fi is that "dual band" capability – coverage of the 2.4 GHz and 5 GHz license-exempt bands, is now available for a modest premium above 2.4 GHz-only equipment. Soon enough the chipset volume increases will justify dual-band Wi-Fi becoming the norm, with 2.4 GHz-only used for the most cost and power consumption sensitive uses.

Wi-Fi in the Enterprise is now ready for prime time. Wi-Fi is finally secure enough, manageable enough (thanks to Wi-Fi "switches") and sufficient capacity thanks to dual-band as discussed in home Wi-Fi. Enterprise Wi-Fi is now to the point that it is cost-effective, sufficiently reliable, and secure to justify wireless-only connectivity in new installations. That's especially important given corporate productivity imperatives such as laptops displacing desktop computers, having laptops in meetings so decisions can be reached based on data at hand, and the overall cost savings from not having to install data (and now, telephone) wiring. Returning to the example of Dartmouth College for a moment, Dartmouth already extensive Cisco Wi-Fi Network will be completely replace with an even more ubiquitous network from Aruba Networks will implement dual band as the norm… Dartmouth needed the extra bandwidth as the network will be expected not only to carry voice… but will become the primary delivery network for *video services* in the near future.

We'll start seeing Ultrawideband (UWB) technology by the end of 2005. The main feature of UWB is that it can deliver extremely high speeds at "around the room" ranges between units. Given such speeds, and the reality of relatively puny (by comparison) broadband connectivity, UWB will be used for things such as connecting high resolution video entertainment units to each other with no inter-unit wiring needed (such units will still require power for the foreseeable future, so systems will not be *entirely* wireless.) UWB will also start to substitute for inter-computer connections such as system-to-monitor, but also connecting external peripherals with "wireless USB".

Not many people have heard of Zigbee, but the vast majority of the population will be using Zigbee devices and networks within twenty years. Zigbee is a signaling and telemetry wireless protocol, optimized for extended battery life and features integrated

mesh networking. Zigbee's intended to link things like your thermostat, security system, nearly anything small, simple, cheap, that has some minimal data communications requirements. One vendor told me that if the device can justify using a microprocessor / microcontroller, it's a near certainty that Zigbee soon be included. Some microcontrollers are being designed so that Zigbee is built-in to the microcontroller.

I'll mention Bluetooth only in passing… while the functionality seems to have been well implemented for devices such as wireless headsets, security seems to be appallingly ill-considered. Bluetooth's also good for low-data rate devices like cordless mice and keyboards (though Zigbee will probably take over those functions.) I don't think Bluetooth has much of a future overall, and thus doesn't merit consideration for the purposes of this story.

Increasingly, Wi-Fi networks are increasingly available when and where you want to use them the most. Several years ago in an article I predicted that Wireless HotSpots (now, Wi-Fi Hotspots) would be more popular in places other than hotels, coffee shops, and airports that were then very visible. My predictions were that truck stops would become very popular Wi-Fi Hotspots (has come true – truckers are aggressive (and grateful, and lucrative) users of laptops and Wi-Fi hotspots) and marinas. Now Wi-Fi HotSpots have appeared in surprising places such as airplanes (Boeing's Connexion service), cruise ships, campgrounds, buses (it's a major feature for Google's shuttle buses in the San Francisco Bay area), golf courses (if you can check the email to see if things are quiet, you might be able to justify another round on a day with good weather), limousines, and probably soon, taxicabs. But Wi-Fi networks are no longer limited (they never were, in truth…) to providing "Hotspot" coverage.

In a case of Déjà vu, the day before I finish this issue of *FOCUS*, Peter Cochrane (ex-CTO of UK telephony carrier BT) described in an article how he drove from Colorado to California and everywhere he went he could find open and free Wi-Fi HotSpots… and he often couldn't get reasonable wireless telephony coverage in those very same areas where he was having an excellent experience with Wi-Fi HotSpots.

One of the most confounding (to the participants in the "Noisy Connectivity Revolution") developments is the emergence of Municipal Broadband Wireless Networks that make use of Wi-Fi. The "Noisies" poo-poo "Muni Wi-Fi" every chance they get – on a technical basis, on a financial basis, misrepresentation (Wi-Fi only works for 100 feet), and it can be reasonably argued… trying to "jam" Muni Wi-Fi by creating a network of "Wi-Fi HotSpots" at phone booths and deploying Wi-Fi-equipped DSL and cable modem routers with the Wi-Fi defaulted to On (clueless as that is on *so* many levels.) Those protests are, increasingly, simply falling on deaf ears as municipal-scale Wi-Fi Networks are being deployed. Again, in the day prior to finishing this issue of *FOCUS*, I read an article by Bill Gurley of Benchmark Capital marveling that with the Municipal Wi-Fi "movement" perhaps eighteen months old, there are already nearly two hundred such systems deployed or under construction.

In short, Muni Wi-Fi works because enough technology and ingenuity has been applied to the problem of making Wi-Fi technology work reasonably well... enough (compared to the alternatives) in such an application. Tropos Networks uses advanced software to create a wireless mesh network out of simple radios. BelAir Networks utilizes multiple radios and multiple directional antennas to increase range between links and reduce interference. RoamAD's units are low cost and can therefore be deployed densely. There are more than a dozen vendors of systems designed specifically for deployment in Muni Wi-Fi networks. It's "ground truth" that Muni Wi-Fi is a reality in many cities now. What's chilling to the "Noisies" is that such technology can literally work anywhere... *especially* the second tier, third tier, and rural markets that they were expecting to be "waiting" for them when they moved beyond deployments of their systems in metro areas.

Here's another example of just how pervasive the Municipal(-scale) Wi-Fi Networks are becoming. Wireless Mesh Networking has been around for a long time. I used a crude, low-speed version of a wireless mesh network called Net/ROM in my earliest days as a (Packet / Digital) Amateur Radio Operator in the mid-1980's. Wireless Mesh has had hundreds of $Millions put into it as part of US Department of Defense (DOD) Defense Advanced Research Projects Agency (DARPA) grants and direct development for wireless mesh systems for military use. It is absolutely the case that by this point, there exists the knowledge of how to implement wireless mesh so that it works very, *very* well. But some of the techniques that are required to make it work well are expensive or tedious or "non-mass market"; one quick example is automatic transmit power control; no point in "blasting" your signal out and polluting the channel if you can talk to your neighbor node perfectly well on a few milliwatts. The promise of wireless mesh is that you don't have to plan an infrastructure – it just evolves organically as the customers buy nodes and put them wherever (including moving them occasionally, or often), and the nodes figure out how to route data between themselves. Within limits, this approach works reasonably well.

Wireless mesh is now being implemented as another layer, primarily software, on commodity Wi-Fi systems. Microsoft Research has developed a "pure software" mesh network system for Windows laptops. Two quick examples of vendor companies using that approach are Qorvus Systems and LocustWorld. Mesh is rapidly getting better as faster processors have gotten cheaper, large amounts of memory are practically free, specialized components such as antenna switches are now commodity parts, and the "radios" have gotten so cheap that you can literally "throw" as many radios as needed at the problem. Radios are so cheap now that it begins to make sense to put a "hot standby" radio into a node in case the primary radio fails; it costs more to service the node than it does to include the hot standby radio.

Wi-Fi Mesh will get even better when the IEEE 802.11s committee finishes its work and implements Wireless Mesh on Wi-Fi as a standard feature of 802.11/Wi-Fi. But, here's the really compelling punch line the Wi-Fi Mesh discussion. A friend explained his experience with Wi-Fi Mesh when he attended a recent conference in Berlin. The audience of this conference were primarily laptop-toting techies, so the conference

arranged for the entire downtown Berlin area around the conference venues to be "seeded" with devices called MeshCubes. (Do look it up on the web, and you'll start to be really amazed.) My friend told me that during the entire time he was at this conference, wherever he went within walking distance of the conference, *he was never out of range of a solid Wi-Fi connection*! He said that the Wi-Fi connection(s) were even stable enough to run VOIP which is notoriously fussy about latency and jitter, two problems that I would have thought to be inherent to a Wi-Fi Mesh Network, especially one that's implemented primarily as software. Again, do go look at just how simple the MeshCubes are... small, simple, cheap, and they *work*.

Chilling as *that* scenario is... an even worse scenario to the "Noisies" is that such systems could easily, quickly, and inexpensively be made interoperable. Think about it... what these systems are providing is Internet connectivity, which means that they already have a network connection in place that would allow the passing of authentication and access information that's behind... **roaming**. With a network already established, establishing "peering" between such Wi-Fi systems requires a robust server (probably distributed) and reasonable bandwidth, and the ability to scale to millions of users. Think about the implications if some entity made it very cheap and very easy to provide such roaming between Wi-Fi systems. I think that such a system would be well within the capabilities of IBM, EDS, Earthlink... (again, this is pure speculation.)

The Unconventional Conclusion; Stitching The Pieces Together

One conclusion that I've reached is that despite the enormous potential that all of the above scenarios represent, they won't displace the elements of the "Noisy" Connectivity Revolution. People will still buy cable modem service, and Verizon BroadbandAccess.

A far more ominous conclusion that I've reached is that, collectively, the elements of the Quiet Connectivity Revolution will "steal" (divert, leach, usurp, siphon...) *sufficient customers and profits from the elements of the Noisy Connectivity Revolution sufficient to render those systems... technologies... carriers... ultimately unprofitable* when you consider that the economics of all of those systems are predicated on getting customers to pay relatively high fees and keeping those customers in the long term.

What happens to Comcast's cable modem revenues when a neighborhood decides easily and inexpensively to share a single cheap, high-speed fiber connection via Wi-Fi Mesh Network? (This is David Isenberg and friends' Paradox Of The Best Network.)

Such an "Ultimately unprofitable" scenario would have enormous second order effects. The US Government is apparently intent on "incentivizing" the largest carriers to achieve universal broadband (laughingly defined in a recent draft of a revamp of telecommunications regulations as "faster than 64 Kbps".) What happens to US competitiveness in the worldwide Broadband Economy when it becomes apparent that the presumed profits simply won't be there because customers make use of the elements of the Quiet Connectivity Revolution?

The only way that the "Noisies" could conceivably soften the effects of the Quiet Connectivity Revolution is to compete aggressively immediately, before the Quiet Connectivity Revolution becomes entrenched. If Comcast drops (permanent) pricing for their 6 Mbps service to $20/month, there's little incentive to try to build a neighborhood Wi-Fi Mesh Network. If Verizon Wireless reduces the cost of BroadbandAccess to $20/month, it makes sense to buy it for those (increasingly rare, but common enough) situations where you don't have Wi-Fi connectivity. At $80/month… it makes sense to look for a free Wi-Fi HotSpot.

If the "Noisies" don't get the clue, their customers will be rapidly become former customers as the technology enables them to simply and easily *bypass* the incumbent broadband infrastructure. Neighborhood-scale mesh might not be built into the next generation of consumer Wi-Fi access points… but it will be built into the generation after that… and with new generations emerging every 9 months or so… the clock is ticking.

In fact, that's probably one of the biggest lessons in this discussion – like Dartmouth, Grand Rapids, and others, *they no longer need* the "Noisies" – they don't need their access to huge amounts of capital, access to licensed spectrum, or access to (formerly) arcane telephony technology (if you haven't heard of Asterisk, look it up; it's a Linux-based VOIP "softswitch".)

As for me, when it's time for me to place my bets, I'll be betting on Moore's Law, Disruptive Technologies, and the Quiet Connectivity Revolution.

(end)

A Brief Note To *FOCUS* Subscribers

Some subscribers have complained about receiving email notifications of postings that I make on my Broadband Wireless Internet Access / WiMAX Weblog at http://www.bwianews.com.

It's a valid complaint, and in response I have discontinued sending weblog notifications to the *FOCUS* subscriber email list. *FOCUS* subscribers will only receive email from me that is directly related to *FOCUS*.

If individual *FOCUS* subscribers wish to receive weblog notifications, you will need to individually subscribe to the weblog notification mailing list at:

`http://www.stevestroh.net/mailman/listinfo/bwia_posting/`

FOCUS On Broadband Wireless Internet Access

FOCUS **On Broadband Wireless Internet Access** is founded upon the following tenets:

1. Internet technology is becoming the foundation for nearly all communications, commerce, and entertainment services;
2. For Internet access to be truly usable, always-on Broadband Internet access is required;
3. By the end of the first decade of the 21st century, Internet access will be ubiquitous;
4. In the "last mile", wireline-based technologies and systems will generally prove to be insufficient or not cost-effective to provide ubiquitous, always-on, Broadband Internet to most homes and businesses;
5. In the near term, Broadband Wireless Internet Access in all its forms – Sub 11 GHz, Above 11 GHz, Free Space Optics, Ultra Wideband, Licensed, License-exempt has emerged as the most likely technology to provide cost-effective, ubiquitous, always-on Broadband Internet Access.

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